

**3.1.5.1 Pit 1.** Information about Pit 1 retrieval in 1969 is sparse. The retrieval was conducted in the fall of 1969 to retrieve some experimental equipment that may have been inadvertently buried in the landfill. The retrieval is explained in one paragraph in an unpublished draft report.<sup>d</sup> Photographs of the retrieval appear in Hiaring, Horton, and Schlafman (1992). Though the experimental equipment was not located, undamaged drums were found to be well preserved; however, boxes had deteriorated. Pit 1 was open from 1957 to 1959; therefore, the waste had been buried for approximately 10 to 12 years. The exact number of drums retrieved is not known, but photographs indicate at least 25 drums. Photographs show a small crew with an excavator removing drums in several locations from Pit 1 (see Figure 3-4.). Pictures show workers wearing street clothes, coveralls, hats, and gloves. Figure 3-5 shows orderly stacked drums, five layers thick, exposed in Pit 1.

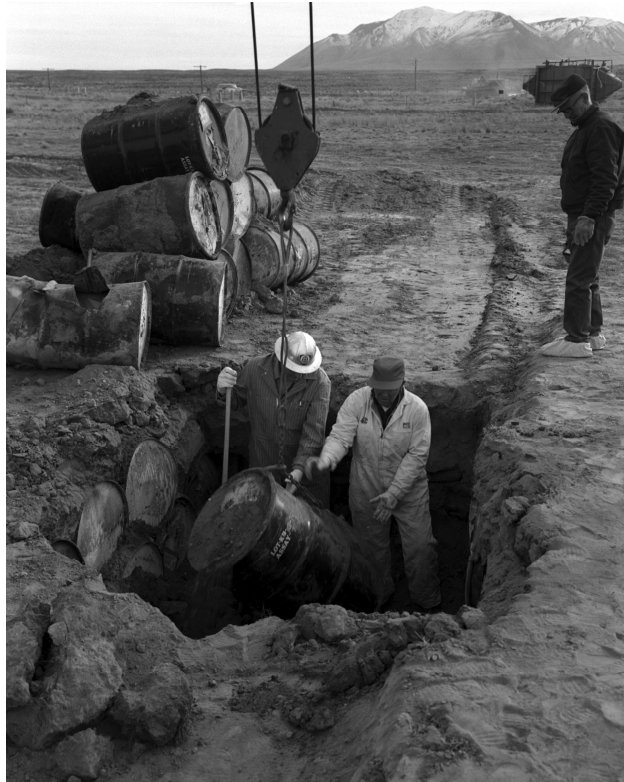


Figure 3-4. Retrieval in Pit 1 in 1969.

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d. Appendix I to a November 1971 unpublished draft report titled “1969 Pit 1 Retrieval, Burial Ground Chronological Historical Development and Highlights.”



Figure 3-5. Orderly stacked drums exposed during the 1969 retrieval in Pit 1.

**3.1.5.2 Solid Radioactive Waste Retrieval Test.** In 1971, a series of solid waste retrieval tests was performed on Rocky Flats Plant waste buried in the SDA to gain insight into problems that might arise during a large-scale retrieval operation. The Solid Radioactive Waste Retrieval Test consisted of excavating and studying contents of drums and boxes from several sites within the landfill. Retrievals focused on removing drums from Pits 2, 5, 10, and 11. Retrievals from each pit and subsequent Hot Cell examinations of retrieved waste are summarized in the following subsections (Thompson 1972). Drums in Pits 2, 5, and 10 were reported to be crushed, corroded, without lids, and leaking liquid. While numerous samples were taken during these retrievals, in no case was soil contamination greater than 5 nCi/g, nor was there evidence of contaminant migration.

**3.1.5.2.1 Pit 2—**Six drums retrieved from Pit 2 were transported to the Auxiliary Reactor Area I Hot Cell for sorting and sampling in 1971. Excavations at Pit 2 were complicated by drums outside pit boundary markers. Flooding in 1962 (see Section 2.2.8) may have caused these drums to move from their original location. Flooding also may have affected the integrity of the drums. Drums removed from Pit 2 had been buried for approximately 12 years and were in the poorest condition of any encountered during the retrieval test. Soil cover over the drums measured 30 to 46 cm (12 to 18 in.). Some drums were corroded through, and sludge was leaking from them. On two occasions, clear liquid leaked from sludge drums. Some drums were open, and plastic liners were not evident. The general condition of the drums and the potential for contamination slowed retrieval operations. Plutonium concentrations in the interstitial and underburden soil varied from 1E-03 to 1E-01 nCi/g. Contamination at this level made working conditions difficult because respirators and frequent changes of protective clothing were required.

**3.1.5.2.2 Pit 5—**Five waste drums were retrieved from Pit 5 and sent to the Auxiliary Reactor Area I Hot Cell for examination in 1971. Waste containers had been buried for approximately 7 years. Initial efforts to open the pit were not successful because waste was not located at the pit's edge, but was found approximately 6 m (20 ft) inside the pit boundary. Drums were randomly oriented with

large quantities of dirt interspersed between them. About one-half of the material excavated was interstitial soil. One-fourth of the drums were damaged or lidless. Drums damaged during excavation were either bagged and retrieved, or bagged and left in place. Six of 16 drums were identified using attached labels and historical shipping records. One sludge drum, damaged during excavation, discharged clear liquid.

Several plastic-wrapped Rocky Flats Plant air filters were found. Remnants of cardboard cartons that had contained the filters also were found. The filters had direct radiation readings of 20 mR/hour at a distance of 0.9 m (3 ft). A soil sample taken adjacent to the filter boxes showed plutonium contamination of 1.14 nCi/g. The filters were not retrieved because site controls at the retrieval site were not considered adequate to prevent environmental contamination or minimize personnel exposure.

A wooden box also was identified for retrieval. The top of the box was missing, and the wood was severely deteriorated. Radiological control smears indicated surface contamination of approximately 1,000 dpm. The box and its contents were left in place, based on evidence of contamination and poor physical condition. Thompson (1972) concluded, "Future excavations in dumped pits where wooden boxes are involved probably will require special attention and the contents of the wooden boxes removed piece-by-piece."

**3.1.5.2.3 Pit 10**—Pit 10 was opened in 1971 to retrieve a specific drum (i.e., Drum No. 771-3431). While disposal records indicated that Drum No. 771-3431 had been buried in Pit 10, it was not found, nor was any other drum from the same shipment. Approximately one-half of the drums were without labels, and one-fourth were lidless or crushed.

The random orientation of the drums, resulting from disposal by dumping, greatly complicated waste retrieval. Many seriously damaged drums were found, some with the inner liner ruptured. The drums appeared to have been damaged by heavy equipment used to cover waste after burial. Corrosion, though present, did not appear to significantly compromise drum integrity. Loose debris—protective mask canisters, tags, plastic material, and drum lids—was dispersed throughout the excavation. Because drums had to be excavated and lifted by hand, only 24 drums were uncovered over a 3-day period. The Pit 10 excavation was the first buried waste retrieval where respirators were routinely used to protect personnel. Whole-body counts of laborers who performed the manual excavation showed no detectable plutonium intake. A soil sample taken before excavation began showed plutonium concentrations of 6.22E-04 nCi/g (Thompson 1972). A sample of interstitial soil obtained during excavation showed a plutonium concentration of 2.28E-01 nCi/g.

**3.1.5.2.4 Pit 11**—Disposal records indicated that Pit 11 contained two specific drums targeted for the retrieval test (i.e., Drum No. 771-7285 and Drum No. 771-16500). Five additional drums also were to be retrieved for examination in the Auxiliary Reactor Area I Hot Cell. Drum No. 771-7285 was found close to the location identified in disposal records and retrieved in 1971. Retrieval of this drum was relatively straightforward. Topsoil was removed with a backhoe, and the exposed drums were retrieved using a chain-hook lifting device. Drum No. 771-16500, the other targeted drum, was part of a backlog of 5,000 drums placed in temporary storage during the winter of 1970. As a result, drums from this shipment may have been mixed with other shipments. Thirty of 152 drums from the shipment containing Drum No. 771-16500 were found, but the rest, including Drum No. 771-16500, could not be found. Five drums, selected at random, were removed from Pit 11 and transported to the Auxiliary Reactor Area I Hot Cell for sorting and sampling. These included one drum of sludge and four of debris that had been buried for approximately 1 year. Nine soil samples were taken between and under the drums, and plutonium concentrations were 2E-03 nCi/g or less (Thompson 1972). Soil contamination likely resulted from mixing waste and interstitial soil during excavation.

**3.1.5.2.5 Results of Hot Cell Sorting**—Sixteen drums retrieved from the SDA were opened and qualitatively examined for general drum and waste condition. Drum condition varied from excellent (nominal corrosion) to poor (corroded through) as a result of both age and method of handling during burial. Drums that were dumped, bulldozed, and crushed generally were in bad condition. Plastic bags lining the drums exhibited a wide range of conditions, from damaged liners to sealed liners with contamination well contained. Some drums had no liner. Moisture content in the waste varied from dry to saturated with free liquid.

The following observations were made during the sorting and sampling phase of the test. Labels on seven of 16 drums were illegible; therefore, Rocky Flats Plant assay data for these drums could not be identified. Sixteen drums averaged 80% full; two drums were 40% full, and seven drums were 100% full. Approximately 37% of the waste was noncombustible (e.g., metal, wire, and equipment), while 63% was combustible (e.g., paper, rags, rubber gloves, plastic, and wipes). Drums that had been buried 18 months were in good condition with light surface rusting, and ring closures could be removed by unscrewing the fastening bolts. However, drums that had been buried for 7 to 12 years were heavily rusted, with one drum completely rusted through. Bolts holding ring closures of these drums had to be cut off with a hacksaw. Nine of the 16 drums were not sealed, the rubber seals were displaced, and water obviously infiltrated. Use and condition of plastic drum liners varied significantly: three drums had no liner; five liners were folded over, but not taped shut; three liners were taped shut, but punctured or rotted; and five liners were taped shut and intact. Two sets of health physics smears were taken from each drum. The first set was taken from outside the drum before the lid was removed. The second set was taken from the underside of the lid and on top of the waste just after the lid was removed. Smears taken from outside the drum were less than 100 cpm. The highest smear count from inside a lid was 55,000 cpm. Four drums had liquid standing in the bottom, and five were dry. The remaining seven drums were damp, either from wet wipes and rags found inside, or from water that had leaked into the drum. Drums that could be identified using Rocky Flats Plant numbers contained waste that was consistent with the contents listed in Rocky Flats Plant records.

**3.1.5.3 Initial Drum Retrieval Project.** The Initial Drum Retrieval Project is a good example of drum retrieval under practically ideal conditions. The drums were buried from 1968 to 1970. They were stacked, very little damage had occurred during disposal, and heavy equipment had not been used to spread or compact them. The drums were retrieved from 1974 through 1978. The Initial Drum Retrieval Project demonstrated safe retrieval, packaging, and transfer to interim storage of drums containing TRU waste. All drums from Pits 11 and 12 (the most recently buried Rocky Flats Plant waste drums) were retrieved, repackaged, and transferred to TSA Pad R or were placed on Pad A in the SDA. Drums containing TRU waste were transported to TSA Pad R, and non-TRU waste drums containing Rocky Flats Plant evaporator salts and depleted uranium were transported to Pad A. The project initially repackaged waste drums using 83-gal overpacks, but then changed to using cargo containers that held 72 drums. This change substantially reduced costs and improved productivity.

The viability of retrieving recently buried drums that had been placed in orderly stacks was demonstrated. In total, 20,262 drums were retrieved, with a waste volume of 4,397 m<sup>3</sup>. The retrieved drums were in good condition, and interstitial soil was not contaminated. Approximately 6.1% of the drums (1,236 drums) had external alpha contamination to 120,000 cpm, and all of these had come from Pit 11 (McKinley and McKinney 1978a). Drums from Pit 12 had no removable external contamination. Approximately 2.4% of the drums (486 drums) were breached, and about one-third of these (162 drums) had leaked liquids. The leaking liquid usually did not contain radioisotopes, though contamination levels up to 40,000 cpm were found in some cases.

**3.1.5.4 Early Waste Retrieval Project.** The Early Waste Retrieval Project was designed and implemented to investigate problems with removing buried TRU waste. Retrievals from Pits 1 and 2 and Trenches 1, 5, 7, 8, 9, and 10 were implemented in 1976, 1977, and 1978. Project goals are listed below:

- Develop methods and equipment to retrieve buried TRU waste safely
- Develop methods to handle and repackaged retrieved TRU waste
- Determine risk and hazards involved with TRU waste retrieval
- Develop methods to minimize risk and hazards of waste retrieval
- Provide data and information to design future retrieval equipment and facilities
- Provide data and information to select a long-term waste management alternative
- Determine extent of TRU isotope migration into soil in pits and trenches.

Waste was retrieved within an air-support weather shield that contained a moveable confinement building. The weather shield was a fabric structure that allowed all-weather operations. The confinement building was a portable metal structure with a change booth and personnel entrance that controlled contamination spread during entry and egress. The confinement building was maintained at negative air pressure relative to the weather shield. Workers wore air-supplied bubble suits, similar to currently used Level A personal protective equipment (see Figure 3-6.). Waste was excavated using a tractor equipped with a front-end loader and backhoe, and by manual labor. Retrieved waste was repackaged as required, using plastic bags or overpack drums. Loose waste was bagged and placed in drums or cardboard containers. Heat stress was an issue for workers in bubble suits during summer.

From 1976 through 1978, the Early Waste Retrieval Project retrieved 457 buried drums (i.e., 94.5 m<sup>3</sup> of containerized waste, 34.4 m<sup>3</sup> of loose waste, and 24.3 m<sup>3</sup> of contaminated soil). Operations generated 17.2 m<sup>3</sup> of waste from all retrievals. Though retrievals in Pits 1 and 2 and Trenches 1, 5, 7, 8, 9, and 10 demonstrated that waste could be removed safely, procedures used to maintain environmental control severely limited productivity.

**3.1.5.4.1 1976 Early Waste Retrieval Project—**In 1976, Early Waste Retrieval Project operations began approximately 140 m (460 ft) west of the southeastern corner of Pit 2 (Thompson 1972). Operations began in Pit 2 because it was thought that the flooding in February 1962 would have most compromised the integrity of the buried waste drums. Retrieval began in May 1976, and a total of 42 m<sup>3</sup> of waste was retrieved by the end of September 1976. Most of the waste was repackaged in new drums before transfer to TSA Pad R. Retrieved waste consisted of 80 buried drums (i.e., 16.6 m<sup>3</sup> of containerized waste) and 25 m<sup>3</sup> of loose waste and soil. Five drums were damaged or were missing covers, but no free liquid was observed. Ten drums leaked liquid when removed from the landfill; four leaking drums contained contaminated liquid, but only one resulted in soil contamination. Contamination was totally contained within the confinement building.

In July 1976, the confinement building was moved to the eastern end of the weather shield. When retrieval was resumed, 12 drums of waste were retrieved without encountering soil contamination. However, two drums leaked a clear liquid contaminated with Pu-238. The drums were bagged and placed into overpack drums. The resulting soil contamination was dispersible and readily spread by air. The area from which the drums were retrieved was covered with plastic and soil, and retrieval activities were moved to another area within the confinement building. This incident proved that contamination, difficult to contain and requiring special procedures to handle safely, could be encountered during retrieval operations.